DuPage River Salt Creek Workgroup

Summer 2023

IN THIS ISSUE

LETTER FROM THE PRESIDENT

Dave Gorman

The DRSCW and LDRWC[1], on behalf of its participating members, will file the required Nutrient Implementation Plan (NIP)[2] with the Illinois EPA by the end of this year. These plans are being developed across Illinois by wastewater treatment plants (WWTPs) that discharge upstream of phosphorous impacted waters. The plans seek to achieve an ecologically protective level of phosphorous in rivers by quantifying inputs from wastewater, stormwater and other sources, and then planning reductions to meet a protective level. The high costs to achieving these reductions will fall on WWTPs. Data shows that locally, 85% of riverine phosphorous comes from WWTPs, with the rest from stormwater and other background sources (state wide 48% is from WWTPS).

What is the ecological protective level of phosphorous in an Illinois River system? We don't yet have an official answer to this critical question. Despite Federal pressure and decades of effort, the Illinois EPA has been unable to develop one. This is not due to a lack of effort. The State has spent the last few decades trying, most recently by forming the Nutrient Science Advisory Committee (NSAC), whose findings we cover in this newsletter. Phosphorus' impact on rivers and aquatic life is extremely complex. Unlike other pollutants, it works indirectly to impact water quality and aquatic organisms. In certain conditions, phosphorous may cause excessive algae growth that outcompetes other organisms (e.g., fish) for dissolved oxygen. Additionally, the high cost to achieve further phosphorus reductions inevitably makes for an extremely scrutinized regulatory process.

This brings us to NIPs. The NIP process allows WWTPs to identify phosphorus input reductions that they can demonstrate would protect water quality. The DRSCW, along with our partners in the Lower DuPage River, have been working on this problem for a number of years. We have developed a watershed-specific target that would be environmentally protective while also being economically efficient. The questions of how we developed this target, how phosphorous affects rivers, and what is the NIP, are all covered in this focused newsletter.

Our shared NIP is vitally important not only to keep our member WWTPs in compliance with their permits, but also to avoid the otherwise expected adoption of the NSAC reduction target, which would be more than twice as restrictive as our locally-developed target. The NIP provides an opportunity to control our own phosphorous strategy and schedule for the next few decades. As is true for so many things, we are more effective and efficient by working together, and we thank you for your support!

[1] DuPage River Salt Creek Workgroup (DRSCW); Lower DuPage River Watershed Coalition (LDRWC)

[2] The names NIP and NARP are used in this document synonymously. NIP was the name originally given the plans in local permits, but it evolved into NARP in later permits elsewhere in the state and is often referred to using the latter.

PHOSPHOROUS: A DOUBLE EDGED SWORD

Phosphorus is a nutrient that is essential for life. In surface bodies of fresh water, it is particularly important to the growth of aquatic plants, but in excessive quantities it can lead to eutrophication. Phosphorus is often the limiting nutrient in freshwater environments, and even small quantities in rivers and lakes may trigger algal blooms. While elevated phosphorus levels are problematic by themselves, it is the consequences of algal blooms as a result of nutrient-rich water that we are particularly concerned with.

Eutrophication: The enrichment of a body of water with nutrients, particularly phosphorus and nitrogen, leading to excessive aquatic plant growth.

Hypoxic: The absence of adequate dissolved oxygen in an aquatic environment.

Anoxic: Aquatic environments that are depleted of dissolved oxygen. Severe hypoxia.

Excessive algal growth has numerous harmful effects on the environment. Best understood is how they affect the Dissolved Oxygen (DO) cycle. Algae release oxygen via photosynthesis and consume oxygen as they respire. This cycle tracks with sunlight and leads to hypoxic and, in severe instances, anoxic conditions. Decomposition of algal biomass further contributes to low DO, as the bacteria that consume the dying blooms also consume oxygen. Since fish and aquatic insects require DO to survive, low DO causes die-offs, migrations, and ultimately uninhabitable conditions that constitute violations of State and Federal water quality regulations.

Effects of eutrophication are not limited to the local rivers we discharge to and are responsible for. Massive amounts of nutrients flow downstream from across the Midwest, fueling massive algal blooms in the Gulf of Mexico. The extent of this problem is so large that the US EPA has tasked the states with coming up with "Nutrient Loss Reduction Strategies" to reduce eutrophication in surface waters. By managing this requirement at the local level, watershed-based entities can help to ensure that their tributary rivers in the Mississippi watershed can support aquatic biodiversity, and individual communities and regions can find solutions that best work for themselves. This is the strategy behind the NIP.

In addition to the harmful effects of phosphorus on aquatic life, human health also suffers from eutrophication. Some species of algae release dangerous toxins that require the closure of lakes, rivers, and beaches. Many areas also suffer economic losses. Fisheries are harmed when fish kills occur, tourism is affected when rivers and lakes are filled with unsightly and odorous algae, and property values can be depressed from chronic algal blooms.

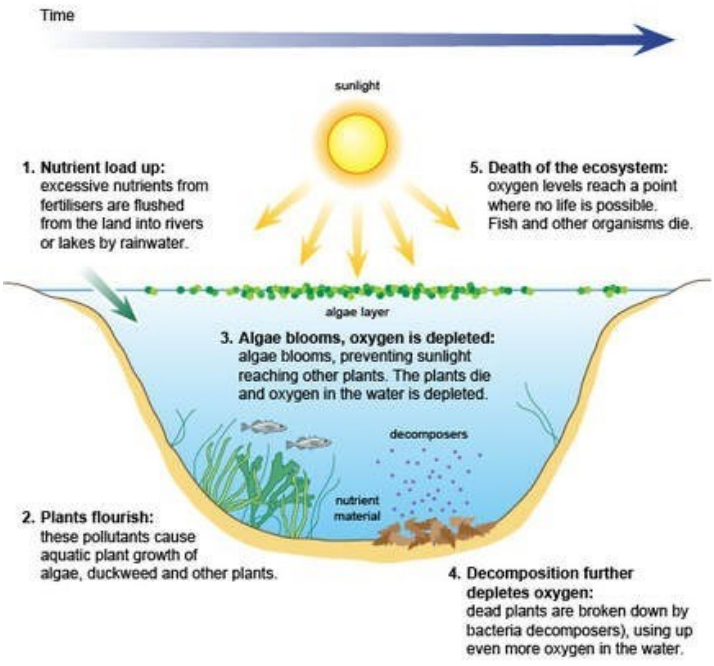

Figure 1. Eutrophication Process and Water Quality Indicies- adapted from Rabar Mohammed Hussein, Bulent Sen, and Feray Sonmez. (2019). International Journal of Engineering Technologies and Management Research, 6(9), 76-83. DOI: 10.5281/zenodo.3475130

Phosphorus is both an important resource and harmful waste product. As such, it requires thoughtful management in its uses, removal and disposal.

NIPS/NARPS: WHAT ARE THEY?

Across Illinois, wastewater treatment plants (WWTPs) are developing Nutrient Assessment and Reduction Plans (NARP) as part of their NPDES permit. In the DRSCW permits, the NARP is referred to as a Nutrient Implementation Plan (NIP). The Illinois EPA requires these plans if the WWTP is located upstream of a waterbody or segment that has been determined to have an impairment related to phosphorus, or to be at risk of eutrophication. WWTPs may work together on a watershed basis to prepare and submit a NARP or they may choose to work individually.

The main objectives of the NARP is to identify phosphorus input reductions from point and nonpoint sources, as well as any other measures necessary to help ensure that dissolved oxygen (DO) and "offensive condition impairments" (excessive aquatic algae and plant growth) standards are met throughout the watershed. Based on Illinois EPA guidance, the NARP should identify a watershed-specific instream target for total

phosphorus (TP) and/or other pollutants. Furthermore, if a watershed-specific TP target were to not be recommended by a NARP, then the TP and TN (Total Nitrogen) targets recommended by NSAC should be utilized. Other measures for improving water quality such as dam removals and stream restoration projects and future studies and monitoring projects can also be considered in the NARP. The NARP should include a schedule for reaching the watershed-specific instream target and other identified measures. The watershed-specific TP target, water quality improvement projects, and future monitoring and studies recommended in the NARP will likely be included by the IEPA in future NPDES permits.

Currently, sixty-six (66) facilities are developing NARPs individually and eighty-six (86) facilities are developing NARPs as part of a watershed group. Fifty-seven (57) were found to not meet the criteria necessitating a NARP. The majority of the NARPs are due on December 31, 2023 or December 31, 2024.

WHAT IS PROTECTIVE?: ARRIVING AT A NUMBER

The DRSCW and LDRWC have identified an instream watershed-specific phosphorous target of 0.11-0.28 mg/L as being sufficiently protective of aquatic life to meet the law in Northeastern Illinois. This range was derived from plotting the relationship between the phosphorus concentrations and the fish species observed across hundreds of locations in NE Illinois (see Figure 2).

The analysis revealed the expected pattern of decreasing species diversity and individual fish numbers as phosphorous concentrations increased. The IEPA measures ecological integrity using a biodiversity score called the Index of Bio-integrity (IBI) which requires a certain number of high value species be present.. By mapping the state's fish IBI onto our phosphorous concentration/ fish relationship, we identified sites that met the IEPA's IBI goal, and their mean phosphorous concentrations.

These acceptable sites phosphorus concentrations were then used to derive our watershed-specific phosphorus target. Since this range is based on empirical data, we have high confidence that aquatic life will meet the State's IBI figure provided that other habitat/pollution criteria are met.

Our own watershed-specific target is less restrictive than the target put forward by the Illinois Nutrient Science Advisory Committee (NSAC). In 2019, the NSAC suggested the adoption of an integrated water quality standard: for a violation to occur, TP must exceed 0.1 mg/L and sestonic chlorophyll-a (a measure of algae presence) must exceed 25 µg/L instream concentration. While these numbers are supposed to be used

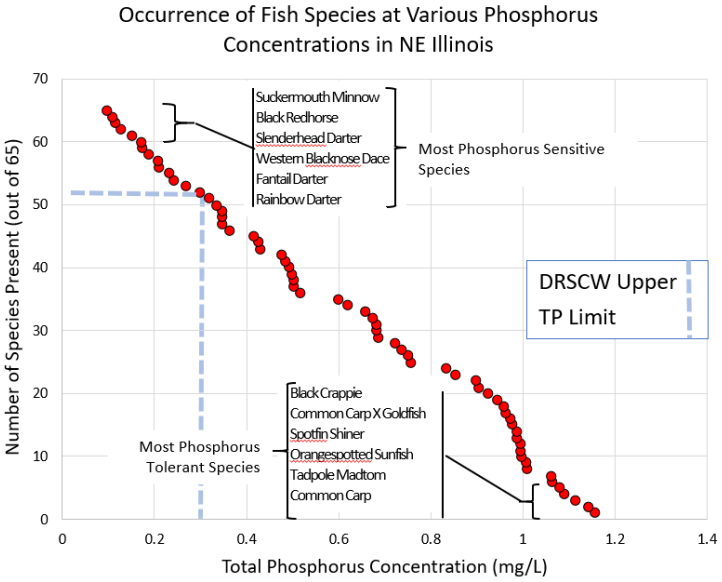

Figure 2. Occurrence of 65 fish species across 640 NE Illinoisan sample sites, ordered by site phosphorous concentrations. The number of fish species supported across the sites decline as the phosphorus concentration increases. The most phosphorus sensitive and tolerant fish are highlighted. Phosphorous concentrations below 0.28 mg/L would be protective of 80% of the species in the study and is sufficient to meet state law (IBI)

in combination, the 0.1 mg/L is often interpreted as a standalone figure and even as a WWTP effluent limit. Our analysis suggests that the NSAC 0.1 mg/L concentration would be overly restrictive, and therefore more expensive, than is necessary to protect aquatic life in our watersheds.

WHAT WILL THE NIP PROPOSE?

The priority recommendation of the DRSCW's NIP will be a TP effluent limit for WWTPs, which along with background dilution, will achieve the instream watershed specific target of 0.11-0.28 mg/L in the watershed's streams and rivers. Options for seasonal limits and various reporting formats (ex. monthly, geometric) are being investigated. The goal will be a TP effluent limit implementation date to be extended to 2035 or later. This schedule will allow our participating WWTPs more time to plan infrastructure upgrades, to benefit from technological advances, and to obtain funding.

The NIP will also continue the DRSCW's adaptive management approach and include physical projects such as stream restoration projects to address specific dissolved oxygen and other habitat related impairments. The NIP may also recommend additional studies and the collection of water quality data to address and monitor DO, nuisance algae and plant growth, and other impairments in DuPage River and Salt Creek watersheds. ■

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